CLAIMS

1. A method of enabling user interaction with computer software running in a computer system via:

an interface surface containing information relating to the computer software and including coded data indicative of at least one interactive element relating to the computer software; and

a sensing device which, when placed in an operative position relative to the interface surface, senses indicating data indicative of the at least one interactive element and generates movement data indicative of the sensing device's movement relative to the interface surface;

the method including the steps of, in the computer system:

(a) receiving the indicating data from the sensing device;

(b) receiving the movement data from the sensing device;

(c) identifying the at least one interactive element from the indicating data; and

(d) operating the computer software at least partly in reliance on the movement data, and in accordance with instructions associated with the at least one interactive element.

2. A method of enabling user interaction with computer software running in a computer system, the method including the steps of:

providing an interface surface containing: information relating to the computer software; and coded data indicative of at least one interactive element relating to the computer software; and

in the computer system:

(a) receiving indicating data from a sensing device, the indicating data being indicative of: the at least one interactive element; and movement data generated by the sensing device, the movement data being indicative of the sensing device's movement

relative to the interface system, the indicating data being sensed when the sensing device is placed in an operative position relative to the interface surface;

(b) receiving the movement data from the sensing device;

(c) identifying the at least one interactive element from the indicating data; and

(d) operating the computer software at least partly in reliance on the movement data, and in accordance with instructions associated with the at least one interactive element.

3. A method according to claim 1 or 2, wherein the interactive element is a hyperlink element relating to the computer software, the method including the step of effecting, in the computer system, an operation associated with the hyperlink element.

4. A method according to claim 3, including the step of sending, in the computer system, data to the computer software indicative of the hyperlink element.

5. A method according to claim 4, including the step of sending, in the computer system, data to the computer software indicative of a name and/or value of at least one field related to the computer software.

6. A method according to claim 3, including the step of sending, in the computer system, data to the computer software indicative of a selected object.

7. A method according to claim 1 or 2, wherein the interactive element is a checkbox field relating to the computer software, the method including the steps of identifying, in the computer system, that the user has entered a hand-drawn mark by means of the sensing device and effecting, in the computer system, an operation associated with the checkbox field.

8. A method according to claim 7, including the step of associating, in the computer system, a true value with the checkbox field.

9. A method according to claim 7, including the step of sending, in the computer system, data to the computer software indicative of at least the checkbox field.

10. A method according to claim 1 or 2, wherein the interactive element is a text field relating to the computer software, the method including the steps of identifying, in the computer system, that the user has entered handwritten text data by means of the sensing device and effecting, in the computer system, an operation associated with the text field.

11. A method according to claim 10, including the step of converting, in the computer system, the handwritten text data to computer text.

12. A method according to claim 11, including the step of associating, in the computer system, the computer text with the text field.

13. A method according to claim 10, including the step of sending, in the computer system, data to the computer software indicative of at least the text field.

14. A method according to claim 1 or 2, wherein the interactive element is a signature field relating to the computer software, the method including the steps of identifying, in the computer system, that the user has entered a handwritten signature by means of the sensing device and effecting, in the computer system, an operation associated with the signature field.

15. A method according to claim 14, including the step of verifying, in the

computer system, that the signature is that of the user.

16. A method according to claim 15, including the step of generating, in the computer system and using a signature key of the user, a digital signature of at least data indicative of a name and/or value of at last one field related to the computer software.

17. A method according to claim 16, including the step of associating, in the computer system, the digital signature with the signature field.

18. A method according to claim 14, including the step of sending, in the computer system, data to the computer software indicative of at least the signature field.

19. A method according to claim 1 or 2, wherein the interactive element is a drawing field related to the computer software, the method including the steps of identifying, in the computer system, that the user has entered a hand-drawn picture by means of the sensing device and effecting, in the computer system, an operation associated with the drawing field.

20. A method according to claim 19, including the step of activating, in the computer system, a hyperlink.

21. A method according to claim 19, including the step of sending, in the computer system, data to the computer software indicative of at least the drawing field.

22. A method according to claim 1 or 2, including the step of printing the interface surface on demand.

23. A method according to claim 22, including the step of substantially

simultaneously printing the interface surface and the coded data onto a substrate.

24. A method according to claim 23, wherein the coded data is printed onto the surface to be substantially invisible to an unaided human eye.

25. A method according to claim 1 or 2, including the step of retaining a retrievable record of each interface surface printed, the interface surface being retrievable using the identity contained in its associated coded data.

26. A method according to claim 1 or 2, including the step of distributing a plurality of the interface surfaces using a mixture of multicast and pointcast communications protocols.

27. A method according to claim 1 or 2, the sensing device containing an identification means that imparts a unique identity to the sensing device and identifies it as belonging to a particular user, wherein the method includes the step of monitoring, in the computer system, said identity.

28. A method according to claim 1 or 2, including the step of providing sufficient information relating to the computer software in the interface surface to eliminate the need for a separate display device.

29. A method according to claim 1 or 2, wherein the interface surface is printed on multiple pages, the method including the step of binding the pages.

30. A method according to claim 1 or 2, wherein the coded data includes at least one tag, each tag being indicative of the at least one interactive element.

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31. A method according to claim 30, wherein each of the tags includes identity data defining the at least one interactive element.

32. A method according to claim 30, wherein the surface is defined by a substrate.

33. A method according to claim 32, wherein the substrate is laminar.

34. A method according to claim 30, wherein the tags are disposed at predetermined positions on the surface.

35. A method according to claim 34, wherein the tags are disposed on the surface within a tessellated pattern comprising a plurality of tiles, each of the tiles containing a plurality of the tags.

36. A method according to claim 35, wherein the tiles interlock with each other to substantially cover the surface.

37. A method according to claim 36, wherein the tiles are all of a similar shape.

38. A method according to claim 37, wherein the tiles are triangular, square, rectangular or hexagonal.

39. A method according to claim 35, wherein the tags are disposed stochastically within each of the tiles.

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40. A method according to claim 30, wherein each of the tags includes at least one common feature in addition to the second identity data.

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41. A method according to claim 40, wherein one or more common features are configured to assist finding and/or recognition of the tags by associated tag reading apparatus.

42. A method according to claim 40, wherein the one or more common features are represented in a format incorporating redundancy of information.

43. A method according to claim 42, wherein the at least one common feature is rotationally symmetric so as to be rotationally invariant.

44. A method according to claim 42, wherein the at least one common feature is ring-shaped.

45. A method according to claim 30, wherein each of the tags includes at least one orientation feature for enabling a rotational orientation of the tag being read to be ascertained.

46. A method according to claim 45, wherein the at least one orientation feature is represented in a format incorporating redundancy of information.

47. A method according to claim 46, wherein the at least one orientation feature is rotationally asymmetric.

48. A method according to claim 46, wherein the at least one orientation feature is skewed along its major axis.

49. A method according to claim 30, wherein each of the tags includes at least one perspective feature for enabling a perspective distortion of the tag being read to be ascertained.

50. A method according to claim 49, wherein the at least one perspective feature includes at least four sub-features which are not coincident.

51. A method according to claim 30, wherein each tag includes a plurality of tag elements, the identity data each being defined by a plurality of the elements.

52. A method according to claim 51, wherein the tag elements are disposed in one or more arcuate bands around a central region of each tag.

53. A method according to claim 52, wherein there are a plurality of the arcuate bands disposed concentrically with respect to each other.

54. A method according to claim 53, wherein each element takes the form of a dot having a plurality of possible values.

55. A method according to claim 54, wherein the number of possible values is two.

56. A method according to claim 54, wherein when representing one of the possible values, the tag elements absorb, reflect or fluoresce electromagnetic radiation of a predetermined wavelength or range of wavelengths to a predetermined greater or lesser extent than the surface.

57. A method according to claim 54, wherein the possible values of the tag elements are defined by different relative absorption, reflection or fluorescence of

electromagnetic radiation of a predetermined wavelength or range of wavelengths.

58. A method according to claim 54, wherein the tags are not substantially visible to an average unaided human eye under daylight or ambient lighting conditions.

59. A method according to claim 54, wherein the tags are slightly visible to an average unaided human eye under daylight or ambient lighting conditions.

60. A method according to claim 54, wherein the tags are visible to an average unaided human eye under daylight or ambient lighting conditions.

61. A method according to claim 30, wherein the first identity data is represented in a format incorporating redundancy of information.

62. A method according to claim 30, wherein the second identity data is represented in a format incorporating redundancy of information.

63. A method according to claim 30, wherein the tags are printed onto the surface by means of a printer.

64. A method according to claim 63, wherein the printer is an ink printer.

65. A method according to claim 64, wherein the tags are printed using ink that is absorbent or reflective in the ultraviolet spectrum or the infrared spectrum.

66. A method according to claim 63, wherein the printer also prints additional information onto the surface.

67. A method according to claim 66, wherein the additional information is printed onto the surface using colored or monochrome inks.

68. A method according to claim 67, wherein the additional information is printed onto the surface using one of the following combinations of colored inks:

CMY;

CMYK;

CMYRGB; and

spot colour.

69. A method according to claim 30, wherein at least a plurality of the tags are disposed stochastically upon the surface.

70. A method according to claim 30, wherein the tags are disposed in a regular array on the surface.

71. A method according to claim 70, wherein the array is triangular.

72. A method according to claim 70, wherein the array is rectangular.

73. A method according to claim 70, wherein the tags are tiled over the surface.

74. A method according to claim 30, further including additional non-tag information disposed on the surface.

75. A method according to claim 1, wherein the region is identified with sufficient precision to distinguish the region from 1.5×10^{14} other regions.

76. A method according to claim 1, wherein any 10 millimetre diameter subregion of the region includes sufficient information to identify the region.

77. A method according to claim 76, wherein any 10 millimetre subregion of the region includes sufficient information to identify at least one point of the region.

78. A method according to claim 1 or 2, wherein the sensing device includes at least one acceleration measuring device for measuring acceleration of the sensing device as it is used to draw the user input onto the surface, the movement data being generated by periodically sampling the acceleration of the sensing device as it is used to draw the user input onto the surface.

79. A method according to claim 78, further including the step of generating movement data in the form of a locus of the sensing means in relation to the surface, the locus being determined by ascertaining relative displacement of the sensing means due to its velocity within each sampling period.

80. A method according to claim 79, wherein the accelerometers are configured to measure at least two orthogonal components of acceleration.

81. A method according to claim 1 or 2, including the step of providing the user with printed information including position elements, the position elements being disposed on a surface, the sensing device being configured to periodically sense position elements as it is used to draw the user input onto the surface, the method including the step of generating the movement data in the form of a locus of the sensing means in relation to the surface by ascertaining relative displacement of the sensing means with

respect to at least one of the position elements.

82. A method according to claim 81, wherein the position elements are disposed on the surface as a regular array of dots, lines or other formations.

83. A method according to claim 81, wherein the position elements are disposed on the surface stochastically.

84. A method according to claim 1 or 2, wherein the movement data is generated by ascertaining a locus of the sensing device in relation to the surface by ascertaining relative movement of one or more motion sensing elements rotatably mounted to the sensing device for contact with the surface while the sensing device is used to draw the user input thereon.

85. A method according to claim 84, wherein the motion sensing elements include one or more rollerballs mounted for rotation within a constraining housing disposed substantially within the sensing device.

86. A method according to claim 85, wherein components of rotation of the rollerball, due to movement of the sensing device when drawing the user input onto the surface, are periodically measured.

87. A method according to claim 86, wherein the components of rotation of the rollerball due to movement of the sensing device by the user when drawing the user input onto the surface are measured by means of:

rollers disposed within the constraining housing for rotation, the rollers being configured to be driven by contact with the rotating rollerball; or

optical sensing of rotation of the rollerball with respect to the constraining

housing.

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88. A system for enabling user interaction with computer software running in a computer system via:

an interface surface containing information relating to the computer software and including coded data indicative of at least one interactive element relating to the computer software; and

a sensing device which, when placed in an operative position relative to the interface surface, senses indicating data indicative of the at least one interactive element and generates movement data indicative of the sensing device's movement relative to the interface surface;

the system being configured to, in the computer system:

(a) receive the indicating data from the sensing device;

(b) receive the movement data from the sensing device;

(c) identify the at least one interactive element from the indicating data; and

(d) operate the computer software at least partly in reliance on the movement data, and in accordance with instructions associated with the at least one interactive element.

89. A system for enabling user interaction with computer software running in a computer system, the system including:

an interface surface containing information relating to the computer software and including coded data indicative of at least one interactive element relating to the computer software;

the system being configured to, in the computer system:

(a) receive indicating data from a sensing device, the indicating data being indicative of the at least one interactive element, wherein the sensing device, when placed in an operative position relative to the interface surface, senses the indicating data and generates movement data indicative of the sensing device's movement relative to the

interface surface;

(b) receive the movement data from the sensing device;

(c) identify the at least one interactive element from the indicating data; and

(d) operate the computer software at least partly in reliance on the movement data, and in accordance with instructions associated with the at least one interactive element.

90. A system according to claim 88 or 89, wherein the interactive element is a hyperlink element relating to the computer software, the computer system being configured to effect an operation associated with the hyperlink element.

91. A system according to claim 90, wherein the computer system is configured to send, to the computer software, data indicative of the hyperlink element.

92. A system according to claim 88 or 89, the computer being configured to send, to the computer software, data indicative of a name and/or value of at least one field related to the computer software.

93. A system according to claim 88 or 89, the computer being configured to send, to the computer software, data indicative of a selected object.

94. A system according to claim 88 or 89, wherein the interactive element is a checkbox field relating to the computer software, the computer system being configured to:

identify that the user has entered a hand-drawn mark by means of the sensing device; and effect an operation associated with the checkbox field.

95. A system according to claim 94, wherein the computer system is configured to associate a true value with the checkbox field.

96. A system according to 95, wherein the computer system is configured to send data to the computer software indicative of at least the checkbox field.

97. A system according to claim 88 or 89, wherein the interactive element is a text field relating to the computer software, the computer system being configured to:

identify that the user has entered handwritten text data by means of the sensing device; and effect an operation associated with the text field.

98. A system according to claim 97, the computer system being configured to convert the handwritten text data to computer text.

99. A system according to 98, the computer system being configured to associate the computer text with the text field.

100. A system according to claim 98, the computer system being configured to send data to the computer software indicative of at least the text field.

101. A system according to claim 88 or 89, wherein the interactive element is a signature field relating to the computer software, the computer system being configured to:

identify that the user has entered a handwritten signature by means of the sensing device; and

effect an operation associated with the signature field.

102. A system according to claim 101, the computer system being configured to verify that the signature is that of the user.

103. A system according to claim 102, the computer system being configured to use a signature key associated with the user to generate a digital signature of at least data indicative of a name and/or value of at last one field related to the computer software.

104. A system according to claim 103, the computer system being configured to associate the digital signature with the signature field.

105. A system according to claim 101, the computer system being configured to send, to the computer software, data indicative of at least the signature field.

106. A system according to claim 88 or 89, wherein the interactive element is a drawing field related to the computer software, the computer system being configured to:

identify that the user has entered a hand-drawn picture by means of the sensing device; and

effect an operation associated with the drawing field.

107. A system according to claim 41, including the step of activating, in the computer system, a hyperlink.

108. A system according to claim 41, the computer system being configured to send, to the computer software, data indicative of at least the drawing field.

109. A system according to any claim 88 or 89, further including the sensing device, wherein the sensing device includes a marking nib.

110. A system according to claim 88 or 89, further including the sensing device,

wherein the sensing device contains identifying data indicative of an identity of the user

111. A system according to claim 110, the computer system being configured to monitor the identifying data when the sensing device is in use.

112. A system according to 88 or 89, the computer system including a printer to print the information onto the interface surface on demand.

113. A system according to claim 112, the computer system being configured to substantially simultaneously print the information and the coded data onto the interface surface.

114. A system according to claim 88 or 89, wherein the coded data is substantially invisible to an unaided human eye.

115. A system according to claim 88 or 89, the computer system being configured to retain a retrievable record of each interface surface printed, the interface surface being retrievable using the identity contained in its associated coded data.

116. A system according to claim 88 or 89, the information being sufficiently detailed in relation to the computer software that a user can interact with the computer system without the need for a separate display device.

117. The system claim 88 or 89, the system being configured to distribute a plurality of the interface surfaces using a mixture of multicast and pointcast communications protocols.

118. A system according to claim 112, wherein the printer includes a binding

mechanism for binding multiple interface surfaces, defined by multiple corresponding pages, into a bound document.

119. A system according to claim 88 or 89, wherein the coded data includes at least one tag, each tag being indicative of the interactive element.

120. A system according to claim 119, wherein each of the tags include identity data defining the at least one interactive element.

121. A system according to claim 119, wherein the surface is defined by a substrate.

122. A system according to claim 121, wherein the substrate is laminar.

123. A system according to claim 119, wherein the tags are disposed at predetermined positions on the surface.

124. A system according to claim 123, wherein the tags are disposed on the surface within a tessellated pattern comprising a plurality of tiles, each of the tiles containing a plurality of the tags.

125. A system according to claim 124, wherein the tiles interlock with each other to substantially cover the surface.

126. A system according to claim 125, wherein the tiles are all of a similar shape.

127. A system according to claim 126, wherein the tiles are triangular, square, rectangular or hexagonal.

128. A system according to claim 124, wherein the tags are disposed stochastically within each of the tiles.

129. A system according to claim 119, wherein each of the tags includes at least one common feature in addition to the identity data.

130. A system according to claim 129, wherein one or more common features are configured to assist finding and/or recognition of the tags by associated tag reading apparatus.

131. A system according to claim 129, wherein the one or more common features are represented format incorporating redundancy of information.

132. A system according to claim 131, wherein the at least one common feature is rotationally symmetric so as to be rotationally invariant.

133. A system according to claim 131, wherein the at least one common feature is ring-shaped.

134. A system according to claim 119, wherein each of the tags includes at least one orientation feature for enabling a rotational orientation of the tag being read to be ascertained.

135. A system according to claim 134, wherein the at least one orientation feature is represented in a format incorporating redundancy of information.

136. A system according to claim 135, wherein the at least one orientation feature is rotationally asymmetric.

137. A system according to claim 135, wherein the at least one orientation feature is skewed along its major axis.

138. A system according to claim 119, wherein each of the tags includes at least one perspective feature for enabling a perspective distortion of the tag being read to be ascertained.

139. A system according to claim 138, wherein the at least one perspective feature includes at least four sub-features, the relative positions of which define a non-degenerate quadrilateral.

140. A system according to claim 119, wherein each tag includes a plurality of tag elements, the first and second identity data each being defined by a plurality of the elements.

141. A system according to claim 140, wherein the tag elements are disposed in one or more arcuate bands around a central region of each tag.

142. A system according to claim 141, wherein there are a plurality of the arcuate bands disposed concentrically with respect to each other.

143. A system according to claim 140, wherein each element takes the form of a dot having a plurality of possible values.

144. A system according to claim 143, wherein the number of possible values is two.

145. A system according to claim 143, wherein when representing one of the possible values, the tag elements absorb, reflect or fluoresce electromagnetic radiation of a predetermined wavelength or range of wavelengths to a predetermined greater or lesser extent than the surface.

146. A system according to claim 143, wherein the possible values of the tag elements are defined by different relative absorption, reflection or fluorescence of electromagnetic radiation of a predetermined wavelength or range of wavelengths.

147. A system according to claim 143, wherein the tags are not substantially visible to an average unaided human eye under daylight or ambient lighting conditions.

148. A system according to claim 143, wherein the tags are slightly visible to an average unaided human eye under daylight or ambient lighting conditions.

149. A system according to claim 143, wherein the tags are visible to an average unaided human eye under daylight or ambient lighting conditions.

150. A system according to claim 119, wherein the first identity data is represented in a format incorporating redundancy of information.

151. A system according to claim 119, wherein the second identity data is represented in a format incorporating redundancy of information.

152. A system according to claim 119, wherein the tags are printed onto the surface by means of a printer.

153. A system according to claim 152, wherein the printer is an ink printer.

154. A system according to claim 153, wherein the tags are printed using ink that is absorbent or reflective in the ultraviolet spectrum or the infrared spectrum.

155. A system according to claim 152, wherein the printer also prints additional information onto the surface.

156. A system according to claim 155, wherein the additional information is printed onto the surface using colored or monochrome inks.

157. A system according to claim 156, wherein the additional information is printed onto the surface using one of the following combinations of colored inks:

CMY;

CMYK;

CMYRGB; and

spot colour.

158. A system according to claim 119, wherein at least a plurality of the tags are disposed stochastically upon the surface.

159. A system according to claim 119, wherein the tags are disposed in a regular array on the surface.

160. A system according to claim 159, wherein the array is triangular.

161. A system according to claim 159, wherein the array is rectangular.

162. A system according to claim 159, wherein the tags are tiled over the surface.

163. A system according to claim 119, further including additional non-tag information disposed on the surface.

164. A system according to claim 88 or 89, wherein the region is identified with sufficient precision to distinguish the region from 1.5×10^{14} other regions.

165. A system according to claim 88 or 89, wherein any 10 millimetre diameter subregion of the region includes sufficient information to identify the region.

166. A system according to claim 165, wherein any 10 millimetre subregion of the region includes sufficient information to identify at least one point of the region.

167. A system according to claim 88 or 89, wherein the sensing device includes at least one acceleration measuring device for measuring acceleration of the sensing device as it is used to draw the user input onto the surface, wherein step (b) includes the substep of periodically sampling the acceleration of the sensing device as it is used to draw the user input onto the surface, and step (d) includes the substep of:

(i) ascertaining a locus of the sensing means in relation to the surface by ascertaining relative displacement of the sensing device due to its velocity within each sampling period.

168. A system according to claim 167, wherein substep (d)(i) includes the substeps of:

[Paul – a definition of the preferred form of locus generation based on velocities and acceleration would be nice here]

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169. A system according to claim 168, wherein the accelerometers are configured to measure at least two orthogonal components of acceleration.

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170. A system according to claim 88 or 89, the printed information including position elements, the position elements being disposed on a surface, wherein step (b) includes the substep of periodically sensing the position elements with the sensing device as it is used to draw the user input onto the surface, and step (d) includes the substep of:

(i) ascertaining a locus of the sensing means in relation to the surface by ascertaining relative displacement of the sensing means with respect to the position elements during periods between reading thereof.

171. A system according to claim 170, wherein the position elements are disposed on the surface as a regular array of dots, lines or other formations.

172. A system according to claim 170, wherein the position elements are disposed on the surface stochastically.

173. A system according to claim 88 or 89, wherein step (d) includes the substep of:

(i) ascertaining a locus of the sensing means in relation to the surface by ascertaining relative movement of one or more motion sensing elements rotatably mounted to the sensing device for contact with the surface while the sensing device is used to draw the user input thereon.

174. A system according to claim 173, wherein the motion sensing elements include one or more rollerballs mounted for free rotation within a constraining housing disposed substantially within the sensing device.

175. A system according to claim 174, wherein substep (d)(i) includes the substep of periodically measuring components of rotation of the rollerball due to movement of the sensing device by the user when drawing the user input onto the surface.

176. A system according to claim 175, wherein the components of rotation of the rollerball due to movement of the sensing device by the user when drawing the user input onto the surface are measured by means of:

rollers disposed within the constraining housing for rotation driven by contact with the rotating rollerball; or

optical sensing of rotation of the rollerball with respect to the constraining housing.

177. A region according to any one of claims 1 to 6, 35, 38 to 43, 55 to 64 or 67, wherein the coded data is machine readable, and the information represented by the coded data is substantially inscrutable to an unaided human.

178. A method according to any one of claims 82 to 88, 93 or 96 to 99, wherein the coded data is machine readable, and the information represented by the coded data is substantially inscrutable to an unaided human.